APPENDIX F. RESIDENTIAL WATER QUALITY PLAN: ALLOWABLE BMP OPTIONS

The following section provides descriptions, advantages, limitations, and schematics of allowable best management practices (BMPs) for use under the Critical Area Residential Water Quality Plan. All of the BMPs allowed under individual residential lot scenarios are considered non-structural BMPs.

For the purposes of this Manual, non-structural BMPs are not given a phosphorus removal rate but are used to reduce or erase proposed impervious cover at the site. These BMPs are organized by several non-structural strategies to reduce the amount of stormwater runoff:

- Strategies to Disconnect Rooftop Runoff
- Strategies to Store Rooftop Runoff
- Strategies to Disconnect Non-Rooftop Runoff

The majority of non-structural BMPs do not require numerical sizing to meet drainage needs. However, to properly function and prevent clogging and nuisance ponding, sizing guidance is provided for french drains, dry wells, and rain gardens.

Strategies to Disconnect Rooftop Runoff

Rain Gardens

Rain gardens are small, vegetated depressions that are used to capture and infiltrate stormwater runoff. Rain gardens are essentially less engineered versions of a bioretention area (see Appendix E). Runoff usually enters rain gardens by sheet flow or from a rooftop downspout. Rain gardens are excavated six to 18 inches deep and are filled with an appropriate soil mixture and planted with shrubs, grasses, or herbaceous, perennial plants (Figure F.1). The surface of the rain garden should be between 20% and 30% of the roof area that will drain into the rain garden (use 20% for very sandy soils). This will ensure that the garden will temporarily hold water from a 1-inch rainstorm. Water is detained in the ponding area until it either infiltrates or evaporates (usually no more than 24 hours). Rain gardens can be applied to both new and existing developments. Due to space requirements, they are most applicable for residential uses. Sizing examples are shown in Table F.1. They work best in areas with well-drained soils (University of Wisconsin-Extension Office). For more information on how to install a rain garden, step-by-step instructions are provided online at: www.cwp.org/Community_Watersheds/brochure.pdf (CWP and SRF, 2003).

Table F.1 Rain Garden Sizing Example

30’ x 30’ house footprint
¼ of this area drains to one downspout
15’ x 15’ = 225 ft^2
20% of 225ft^2 = 45ft^2
30% of 225ft^2 = 67.5 ft^2
The rain garden area should be between 45 and 67.5 square feet, depending on the soil type

Advantages

- Increased public awareness and involvement in stormwater management
- Rain gardens can reduce runoff volume and peak discharge
- Add an appealing landscaping feature to neighborhoods
- Help to disconnect impervious cover

Limitations

- Can create flooding and visual nuisance if not properly designed and maintained
- Require strong owner and community buy-in

Figure F.1 Picture of Rain Garden
(Source: Roger Bannerman)

French Drains and Dry Wells

French drains and dry wells are gravel filled trenches designed to control runoff from rooftops and other impervious areas through infiltration. Runoff is directed to the trench via a downspout or swale, is temporarily stored in the voids of the stone-filled trench, and ultimately percolates into the ground. The terms *french drain* and *dry well* are often used interchangeably since they perform the same function; however, the design and applicability of each will differ slightly. A french drain is an underground, horizontal trench with perforated pipes that run along the bottom of the trench (Figure F.2). A typical sizing example for a french drain is provided in Table F.2. A typical dry well is a vertical excavated trench with perforated pipes that run both vertically and horizontally through the aggregate (Figure F.3). Larger runoff storage capacity can be realized by using larger diameter perforated pipes.

Table F.2 French Drain Sizing Example

French Drain Surface Area = $\frac{(DA)(P)}{12(D)(V)}$

30’ x 30’ house footprint

¼ of this area drains to downspout

Drainage Area (DA) = 15’x 15’ = 225ft^2

Rainfall Depth (P) = 1”

Depth of Proposed Trench (D) = 2ft

Voids Ratio for Gravel (V) = 0.35

$\frac{(225)(1)}{12(2)(0.35)} = 26.8$ ft^2

Trench dimensions: 13’ length, 2’ wide, 2’ deep

Notes:
Depth (D) can vary depending on site constraints
Rainfall Depth (P) can vary; should reflect retrofit water quality target volume or local water quality criteria

Advantages

- Provide groundwater recharge
- Can serve small impervious areas like rooftops
- Helps to disconnect impervious surfaces

Limitations

- Loss of infiltrative capacity and high maintenance cost in fine soils
- Low removal of dissolved pollutants in very coarse soils
- Not suitable on fill sites or steep slopes

- Risk of groundwater contamination in very coarse soils, may require groundwater monitoring
- Lack of pretreatment may cause clogging over time
- Soils must be permeable

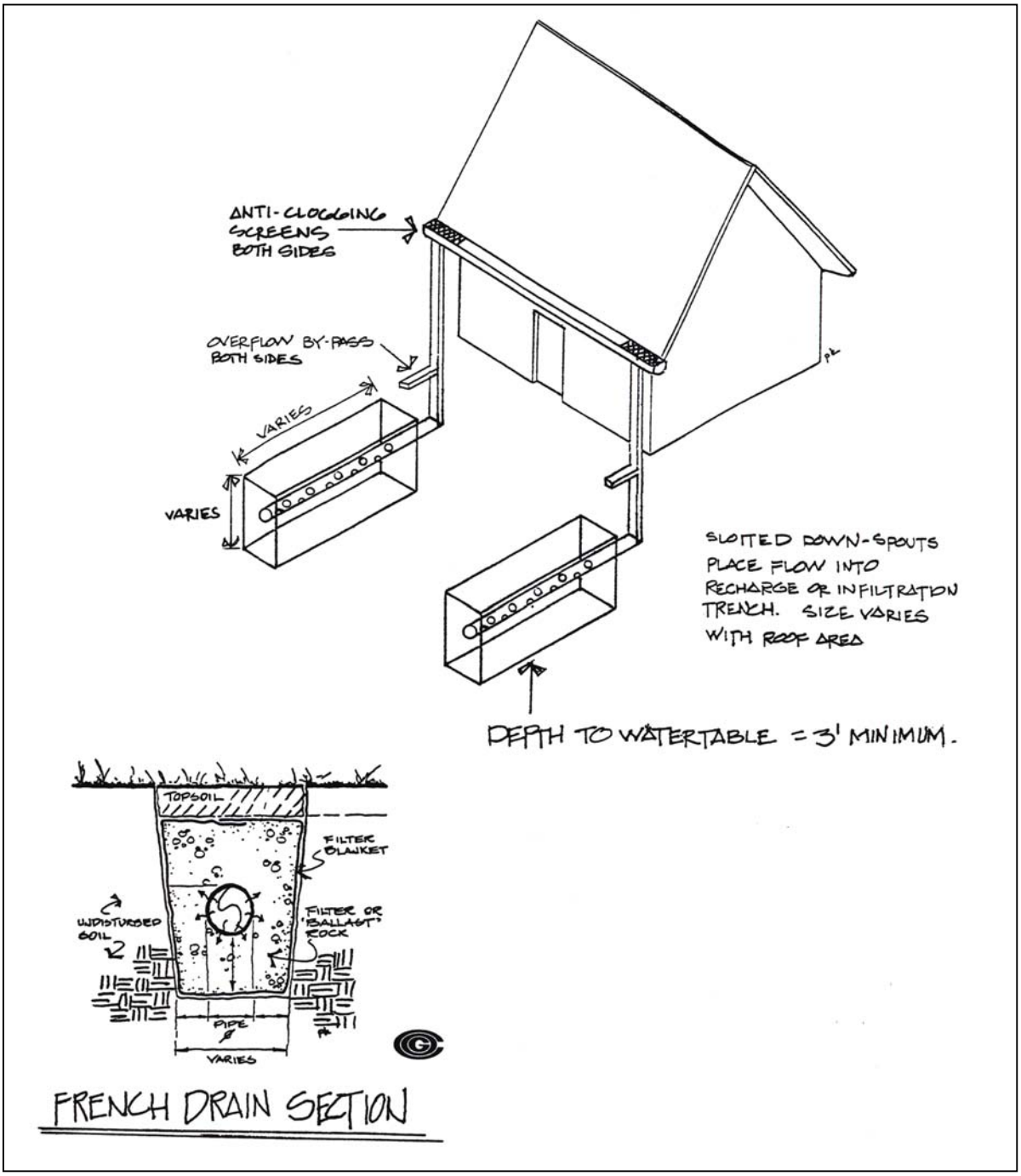

Figure F.2 Schematic of French Drain

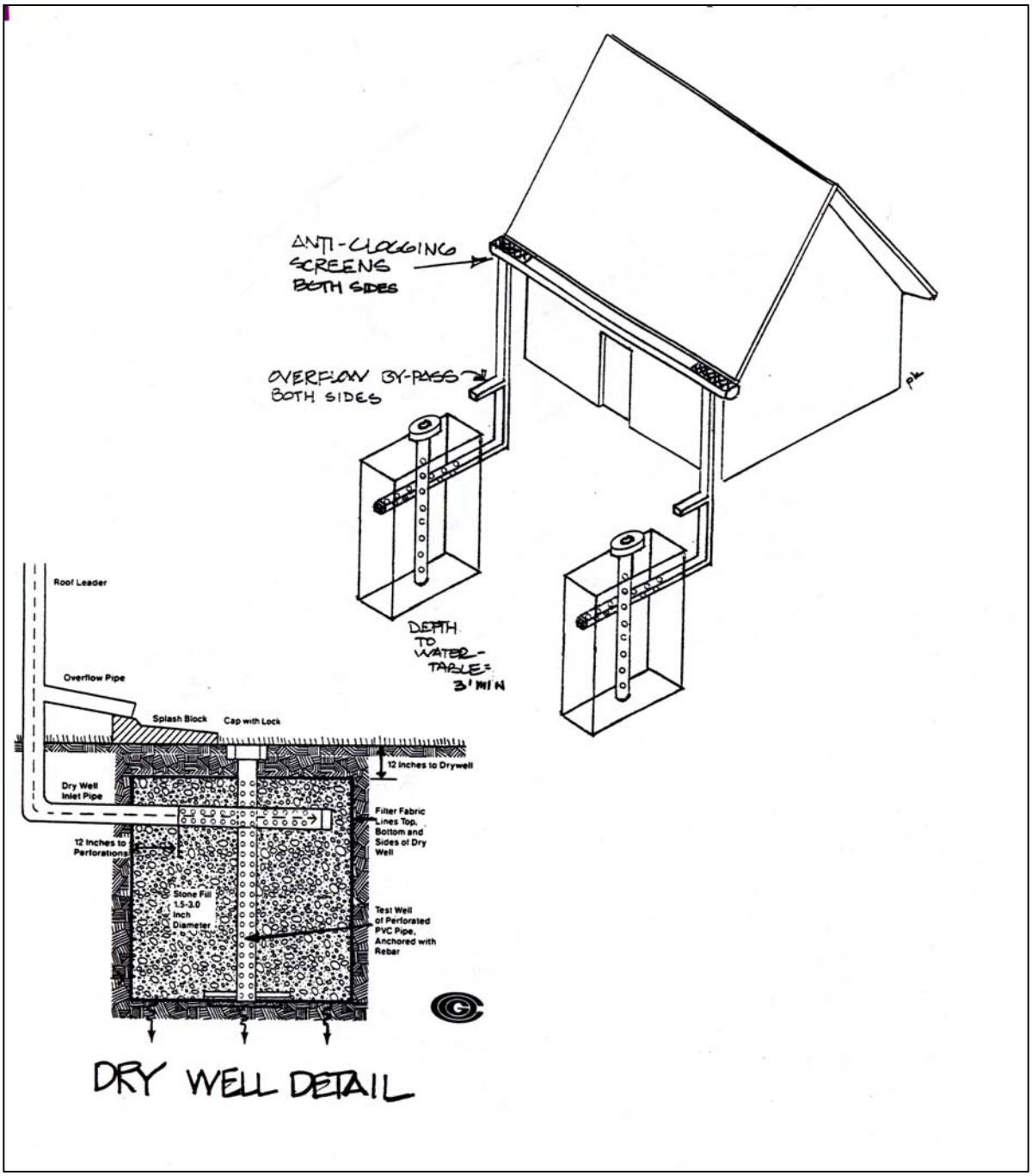

Figure F.3 Schematic of Dry Well

Strategies to Store Rooftop Runoff

Rain Barrels

A rain barrel is a collection device that stores rainwater from rooftops (Figure F.4). This stored water is typically used by homeowners to wash cars or water lawns and gardens. Rooftop runoff stored in a rain barrel would normally flow through the downspout, onto a paved surface, and eventually into a storm drain. Rain barrels are designed to hold between 50 and 100 gallons of water each. For more information on how to install a rain barrel, step-by-step instructions are provided online at: www.cwp.org/Community_Watersheds/brochure.pdf (CWP and SRF, 2003).

Advantages

- Reduce water utility bills
- Promote water conservation and increases public awareness
- Require little space

Disadvantages

- Require strong homeowner maintenance
- Must have on-site infiltration capacity for rain barrel overflow for larger storm events
- Limited effectiveness in cold winters
- Can create foundation and mosquito problems if not maintained properly

Figure F.4 Schematic of Rain Barrel
(Source: www.urbangardencenter.com)

Strategies to Disconnect Non-Rooftop Runoff

Permeable Pavers

Permeable pavers are permeable surfaces that can replace asphalt and concrete and can be used for driveways (Figure F.5), parking lots and walkways. From a stormwater perspective, this is important because permeable pavers can replace impervious surfaces, creating less stormwater runoff. The two broad categories of alternative pavers are paving blocks and other surfaces including gravel, cobbles, wood, mulch, brick, and natural stone.

Advantages

- Can replace conventional asphalt or concrete in parking lots, driveways, and walkways
- Can abate overall stormwater management costs by reducing or eliminating the need of other stormwater management techniques
- Reduces pavement ponding

Limitations

- Slight to moderate risk of groundwater contamination depending on soil conditions and aquifer susceptibility
- High failure rate potential
- Requires regular maintenance
- No sanding for de-icing permitted
- Only feasible where soil is permeable, there is sufficient depth to bedrock and water table, and there are gentle slopes
- Not suitable for areas with high traffic volume
- More expensive than traditional paving surfaces

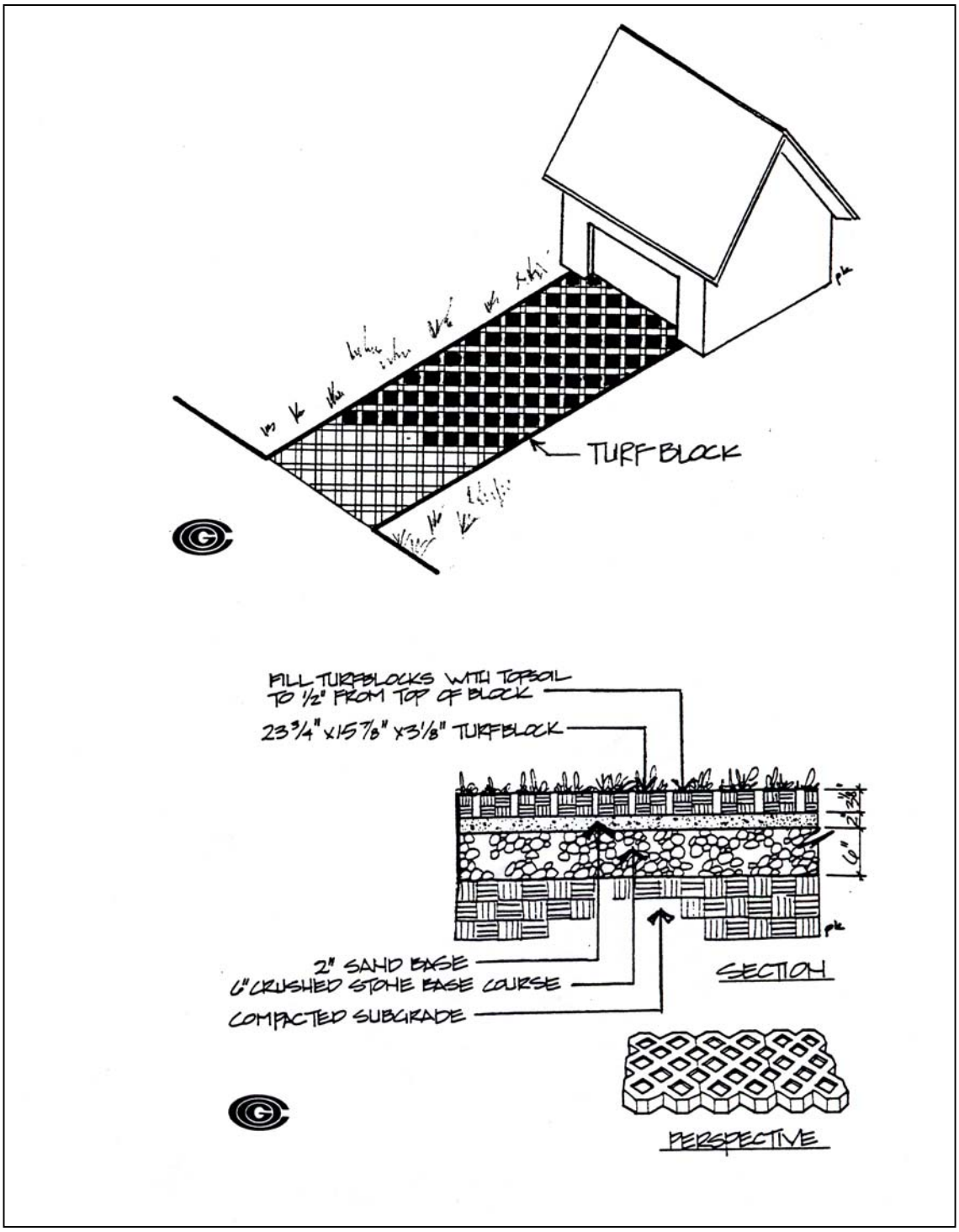

Figure F.5 Schematic of Permeable Pavers
(Source: Metropolitan Washington Council of Governments)

Two-Track Driveway

A two-track driveway (Figure F.6) consists of a grassy strip down the center of the driveway, with pavement on either side to accommodate traffic.

Advantages

- Simple application
- Reduces the amount of impervious cover

Limitations

- May require small amounts of maintenance including mowing

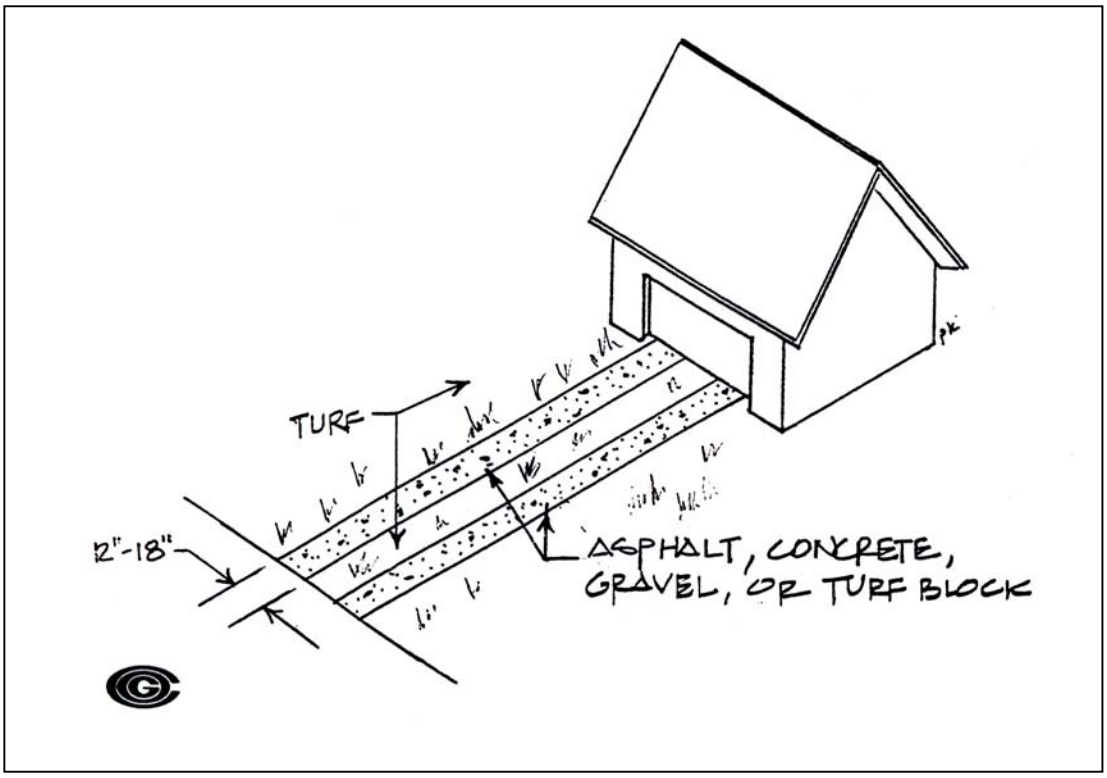

Figure F.6 Schematic of Two-Track Driveway

Pervious Deck Design

A deck can be constructed with gaps between the boards to achieve perviousness (Figure F.7). Additional elements to minimize subsequent runoff include 6 inches of gravel beneath the deck and plantings.

Advantages

- Simple application
- Reduces the amount of impervious cover

Limitations

- Plantings may require limited maintenance

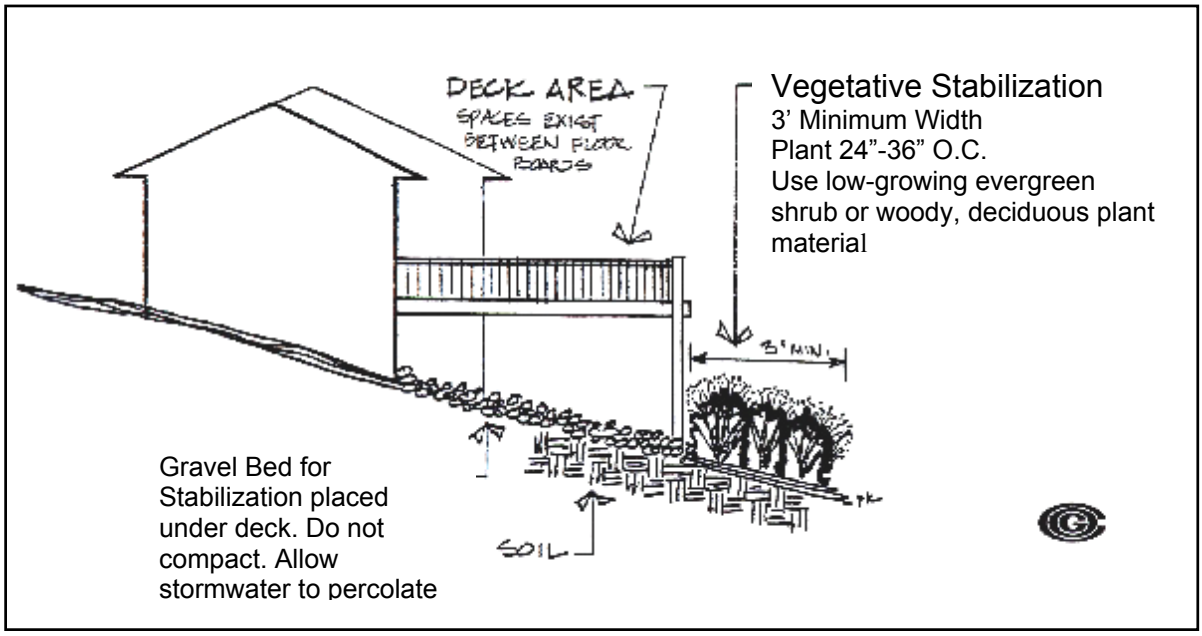

Figure F.7 Schematic of Pervious Deck Design